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A DISCLOSURE OF THE DISCOVERY AND INVENTION AND A DESCRIPTION OF THE PLAN OF CONSTRUCTION AND MODE OF OPERATION OF THE AEROSTAT:

OR A NEW MODE OF AEROSTATION.

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ADVERTISEMENT.

WHEN I first conceived the thought of the plan of Aerostation, disclosed in the following pages, I determined in my own mind not to disclose it to the world until after I had experimented on and established its practicability. Because, first, I was aware of the fact that, hitherto, inventors and discoverers have been deprived of their rights by designing interlopers who happened to have the means for experimenting on and, consequently, forestalling the true and original discoverers both as to the honor and profits of their intellectual labor; and secondly, to save my feelings the chagrin and mortification occasioned by the opposition, ridicule and derision invariably heaped upon all innovators. For it is notorious that the greater and more certain the advantages derived from discoveries and inventions heretofore, the greater and more violent was thê array of opposition against those who originated and advocated them.

But I had no means for experimenting on my theory, and, to keep it to myself, under the daily apprehension of its being discovered by some one else, placed me in a peculiar situation, indeed. I therefore cast about in order to find out how I could raise a sufficient sum for this purpose; and I could think of no plan by which it could, most likely, be done so readily as that of representing, through the public prints, the great advantages of it, if practicable, to the world at large; and offering extraordinary inducements to adventurers, in the shape of premiums on the small sum necessary to test and carry it into useful operation.

But neither of these considerations, it seems, have had any weight in the public mind. And, having recently taken the proper steps to secure to myself the authorship and profits of it, I now lay the whole plan before the people, for their scrutiny and judgment, with the view and hope of being enabled soon to obtain the means for testing its practicability.

R. O. DAVIDSON.

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INTRODUCTION.

MAN, at a very early period of the world, adventured upon an element widely different from that of his own and which, most evidently, was not designed for his special occupancy. The "*great deep*," has its appropriate inhabitants—the fishes are the rightful denizens in the empire of the fluids. But this usurpation, on the part of man, was not attempted in the same mode in which he walked abroad upon the earth—not at all: this would not have answered. Nor did he attempt to erect upon the surface of the ocean, a safe and permanent contrivance on which he might travel from one country to another, in his natural mode of locomotion. This, likewise, would have been entirely impracticable. But taking advantage of experience, gathered by observation from the swimming of the fish or, perhaps, the graceful ease and gentle gliding of the swan upon the smooth surface of the water, he adopted, as far as circumstances would permit, the forms of these animals—in constructing the machinery for navigation—and, along with the form, the proper principle also.

Hence we find, in ancient history, accounts and representations of boats and other large vessels made or constructed in the form of the peacock, the swan and various other animals belonging to or which frequent the water. And, even to this day, (as must ever be the case,) there is a strong resemblance between the form of the keels of all vessels used in navigation and the breast and structure of the under part of the bodies of birds and the fish; and especially the tail of the latter and the rudder of the ship. In this contrivance (the rudder) nature was exactly patterned after; and the oars on each side of the galley boat, were equally striking imitations of the fins on the sides of the fish.

Now, although the inventor of the first boat or ship might not have been aware of the fact, yet it is true, that his plan rested upon a principle founded in nature. He did that in a contrivance of art, made of materials which were lighter than and propelled upon the surface of the water, which the fish did, in passing through it. Any one who will take the trouble

to reflect on this subject will see at once the correctness and beauty of this position. Now-a-days, since navigation has been so long practised, we all understand the philosophy of it, and see clearly that any other mode than that which is universally adopted would be futile and impracticable. For instance, it would not answer to attempt to contrive means to walk upon the water; nor to build roads upon it; nor to go through it like the fish, underneath its surface; nor yet to navigate it with vessels constructed in a form that would not float upon or be buoyed up by its surface. The closer nature is imitated, in this case, the more easy and certain will navigation be accomplished. The form therefore must be adopted, and as far as practicable, the means also, for propelling this form, must represent the fins of the fish. The size of the vessel and the weight carried are regulated of course by the force of the power employed.

But, think you kind reader, that he who first had the hardihood to set sail on the bosom of the ocean, was regarded as being wise or accredited for his ingenuity by his cotemporaries? If so, men were wiser and more charitable in the early history of the world, than they were in the days of Columbus, Watt and Fulton. I rather suspect that he who first had the audacity to say it was practicable to navigate the sea, was deprived of his life for his temerity; and, perhaps, a monument was afterwards erected to his memory. As was the case with the great Socrates, for teaching the Athenians correct philosophical doctrines.

In modern times—and especially in the latter part of the 18th and during the present century—a great number of extraordinary and useful discoveries and inventions have marked, as with the finger of inspiration, this mighty era of the world. And perhaps the most useful and important of those are the discovery of steam power and the invention of the steam engine—and, especially, when constructed with regard to their joint application to locomotion on land. And, in this case, like that of navigation, the principle is founded in nature. But, unlike the former, the form of the machine was not taken from nature, as it doubtless should have been.

The locomotive steam engine is, in principle, a *horse;* the steam and machinery answering to or being in the place of

the muscular action and power of that animal; and the wheels on which it rests answer to the legs and feet and their alternate strides. The form of the horse, therefore, should have been adopted if, indeed, it was rightly understood by those who constructed the first locomotive engine,—which, however, I am inclined to doubt. For the advantages, to say nothing of the propriety and beauty of this form, over those which have been adopted, are so apparent it would seem that, if it had been properly understood by those persons who interested themselves in the experiment, on the first application of them to RAIL ROAD transaction, they would unquestionably have adopted it. One half, perhaps more than one half, of the atmospheric resistance which is encountered in travelling in the engines constructed as at present, would be avoided by adopting the well-turned and beautiful front part of the body, and neck, and head of the horse. The wheels might be made to play upon their axles at the knees, and the smoke and steam conducted off so as to dispense with the chimney and steam pipe, in the position they usually occupy.

As to the manner in which the proposition to apply steam power in propelling locomotives on rail roads was received by the world, we are not left to conjecture, as in the case of the introduction of navigation. When the project was first talked of in England, it was almost universally cried down and ridiculed. And to such an height did the public disapprobation of it, at length arise, that it was caricatured in London, the very seat and nucleus of science in the kingdom, in the most ludicrous manner that could possibly be devised.

Let us now ascend from these terrene affairs to a higher region and purer atmosphere—into the third grand element, in point of importance, and which alone remains unoccupied by man; and, upon which, the mightiest efforts of his towering genius have been baffled for centuries gone-by, in endeavors at Aerostation or air navigation.

The romances of almost every nation, says the ENCYCLOPEDIA BRITANNICA, have recorded instances of persons being carried in the air, both by the agency of spirits and by mechanical power; but till the time of Friar Bacon, who died in 1292, no rational principle appears ever to have been thought of by which this might be accomplished. He wrote on the subject

and not only assures us of the practicability of the art, but that he knew how to construct a machine in which a man might transport himself through the air like a bird. This machine consisted of two large thin shells, or hollow globes of copper, which were exhausted of air; and these being lighter than air, it was supposed that they would not only rise but would carry up along with them, the weight of a man. But after much theorizing and some experiments, this first metalic plan was found to be impracticable.

In the year 1672, Bishop Wilkins published a treatise, entitled, The discovery of the New World, in which he mentions the true principles on which ballooning rests; quoting, from Albertus de Saxonia and Francis Mendoza, that the air is in some part of it navigable, upon this static principle; that any brass or iron vessel whose substance is much heavier than that of water, yet being filled with lighter air it will swim upon it and not sink. But this project, like that of Bacon's, proved unsuccessful.

Francis Lana, a Jesuit, cotemporary with Bishop Wilkins, brought the scheme of flying, it is said, to a still more rational principle. He was acquainted with the real weight of the atmosphere, and justly concluded, that if a globular vessel were exhausted of air, it would weigh less than before: and considering that the solid contents of vessels increase in a much greater proportion than their surfaces; he supposed that a metaline vessel might be made so strong, that, when emptied of its air, it would rise, with great velocity, into the higher regions of the atmosphere. But though the theory here was unexceptionable, the means proposed were clearly wide of the mark.

The project of Friar Gusman, a Portugese, in 1709, was equally unsuccessful with those that had gone before. His machine was constructed in the form of a bird, and contained several tubes through which the wind was to pass, in order to fill a kind of sails, which were to elevate it, and when the wind was deficient, the same effect was to be produced by means of a bellows concealed within the body of the machine.

In the year 1766, Mr. Henry Cavendish ascertained, as far as was practicable at that time, the weight and other properties of inflammable air, determining it to be at least SEVEN

times lighter than common air. Soon after which it occurred to Dr. Black, that perhaps a thin bag filled with inflammable air might be buoyed up by the common atmosphere; but his professional vocation prevented him from making experiments on his theory. The same thought, however, occurred some years afterwards to Mr. Cavallo; and he has the honor of being the first who made experiments on this plan. He first tried bladders, then Chinese paper; but neither would answer his purpose. His experiments, therefore, made in the year 1782, proceeded no farther than blowing up soap bubbles with inflammable air, which ascended rapidly to the ceiling, and broke against it.

But while the discovery of the art of ærostation seemed thus on the point of being discovered in Britain, it was all at once announced in France. Two brothers, Stephen and John Montgolfier, had turned their thoughts towards this project, as early as the middle of the year 1782. Their idea was to form an artificial cloud, by enclosing the smoke in a bag, and making it carry up the covering along with it. And, accordingly, in November of that year, they made an experiment, by applying burning paper to the lower aperture, the air was rarified, and the bag ascended in the atmosphere to the height of about 70 feet.

In the course of a few years after this, various other experiments were made upon this principle, in which the machines varied in size from 650 to 23,000 cubic feet, some of them presenting the enormous bulk of 75 feet in height and 50 feet in diameter! and the whole apparatus belonging to them, weiging upwards of 1600 pounds? But as it was impossible to do more with these SILKEN CLOUDS than merely attain elevation, by rarifying the air within them, they soon gave place to another kind filled with HYDROGEN GAS.

This was a short time after the discovery had been made by the Messrs. Montgolfiers: and the first experiment was made by two brothers, Messrs. Roberts, and M. Charles a professor of experimental philosophy. The bag which contained the gas was composed of lutestring, varnished over with a solution of elastic gum and was only about 13 English feet in diameter. After encountering many difficulties in filling it with gas and the day announced for a public exhibition

of it having arrived, it was at last set at liberty and, rising in the atmosphere, it remained there three quarters of an hour, during which time it had traversed 15 miles.

The success of this experiment naturally suggested the idea of a balloon; and, in a few weeks afterwards an experiment was made with a machine of this kind, at Paris. Its weight, including that of the two adventurers who went up in it, was a little upwards of 600 pounds. In this case the ascent was easy and after remaining in the air an hour and three quarters, they alighted at the distance of 27 miles from Paris.

The next thing sought to be accomplished by aeronauts, was to discover a means of controling the machines by which they were thus elevated in the atmosphere, so as to direct and propel them. And this was attempted first by a Mr. Blanchard, who had for several years before amused himself with endeavors to fly by mechanical means, though he had never succeeded in the undertaking. In his first attempt he was frustrated by the impetuosity of a young gentleman, who insisted right or wrong, on ascending along with him. In the scuffle which ensued on this occasion, the wings and other apparatus were entirely destroyed; so that Mr. Blanchard was obliged to commit himself to the direction of the winds.

The success of Messrs. Charles and Robert in their former experiments, encouraged them soon to repeat them, with the addition of some machinery to direct them in their course. Having enlarged their former balloon to the size of an oblong sphereoid 46 feet long aud 27 in diameter, they made it to float with its longest part parallel to the horizon. The wings were made in the shape of an umbrella without the handle, to the top of which a stick was fastened parallel to the aperture of the umbrella. Five of these were disposed around the boat, which was near 17 feet in lengrh. And, all things being ready, on the 19th of September 1784, they made their ascent; varying their height from 1000 to 4200, feet above the surface of the earth; and, after remaining in the air some five or six hours, they descended having travelled about 150 miles.

In this case it was clearly ascertained by Messrs. Charles and Robert that but little, if any effect at all, could be producedby either wings or oars, in guiding and propelling the bal-

loon. In their report of the experiment, they say, that, "far from going against the wind, as is said by some persons to be possible in a certain manner, and some aeronauts pretend to have actually done, we only obtained, by means of two cars, a deviation of 22 degrees." And they add, "the wind carried us at the rate of 24 miles an hour, and it is natural to judge, that if the wind had been twice as strong as it was, we should not have deviated more than one half of what we actually did."

During the last 40 or 50 years but little improvement has been made in the SCIENCE OF AEROSTATION. The idea of ever being able to propel and direct the balloon, has been pretty generally given up by those who best understand the philosophy of it. Occasionally, however, we hear of some new plan being set on foot and prosecuted with the greatest confidence. The last attempt to accomplish this great DESIDERATUM, of which I have heard, took place at the Champ de Mars, on the 28th of October last, under the patronage of the French government. And, like all previous attempts, it resulted in a splendid show and signal failure.

Thus, this mode of aerostation, commencing with fire and metal, has ended, as we would very naturally suppose, in glare and vapor.

The principle of ascending in the air by means of the balloon, grows out of the nature of the atmosphere, and is susceptable of the clearest demonstration. But, instead of its aiding the world in discovering the means for navigating the air, I have no doubt but that it has operated as a blind, in regard to that matter. In itself, it is perfectly SUI GENERIS. It acts upon no NATURAL PRINCIPLE; it employs no power, natural or artificial; nor does it imitate any animal belonging to either of the three great elements of the world,—earth, water and air. And, as a matter of course, it can accomplish nothing more than merely attain elevation—upon the same principle that a cork, when immersed into a vessel of water, will rise to its surface again.

How then, you ask, is man to contrive to carry himself upon the atmosphere, with safety and expedition? I answer, by adopting a PRINCIPLE founded in and imitating a MODEL, in constructing his machine, and employing a POWER FURNISHED BY NATURE. In strict analogy with the mode and means em-

ployed in navigating the ocean and accomplishing steam engine locomotion, on land.

These three important—aye, indispensable requisites, properly combined, cannot fail to elevate man upon, and safely and swiftly conduct him through, that "AIRY NOTHING" which has proved too subtle for the unsuitable means hitherto suggested by the ingenuity of man, in endeavoring to overcome its elasticity and ride upon its ambient billows. And, I flatter myself, that I have hit upon these requisites, and combined them in such a manner as to ensure success.

And now, kind reader, permit me, in the conclusion of these introductory remarks, to request of you not to suffer your anticipations to rise too high in regard to this matter; but rather prepare your mind for the reception of something plain and rational, but which must not be condemned on that account.

> 'Tall oaks from small acorns grow,
> And great rivers from little fountains flow.'

Judge not, therefore, before the time; hear the whole and then receive or reject my plan. "Nothing extenuate nor aught set down in malice."

DESCRIPTION OF THE FORM OF CONSTRUCTION AND MODE OF OPERATION OF THE AEROSTAT.

I adopt the form of the American Eagle, and construct it as follows:—

The general dimensions of the body are 8 feet long from the junction of the neck with it to its extremity behind; 4 feet wide and 4 deep at the centre, and converging gradually to a point, each way.

The first and principal piece of the framing of it—answering to the spine—is made of whale-bone, 8 feet long, 1 inch thick and 4 inches wide at that part of it opposite to the places where the wings join the body; thence tapering gradually each way to the ends, where it is 1 inch and a half in width and half an inch thick. This piece, like all the other principal frame-pieces, is encased in corkwood. And it is fastened at each end to the top rims of two hoops 6 inches in diameter, placed in a perpendicular position to its ends. These hoops are made of whale bone, their rims being 2 inches wide and one inch thick. The next is a piece made of the same kind of materials having the same general form and dimensions, except that it is not quite so large, as the first, and is placed below and opposite to the first, and fastened to the under parts of the rims of the hoops, before mentioned. Two other pieces of about the same dimensions and strength of those already described, and made of the same kind of materials, are placed on each side opposite to and parallel with each other, and secured to the hoops in like manner to the first. In addition to these, there are two pieces, which I call centre braces made of whale bone also, 1 inch thick and 2 inches wide each, placed around the body 18 inches apart and equi-distant from its centre, with reference to the point of its equilibrium. Small ribs of whalebone or wickers are next placed between and parallel to the large frame-pieces, and fastened likewise to the hoops before and behind; and, the frame of the body is

then completed, by crossworking the whole with small brass wire or rush splits, giving to it eveness and rotundity.

This body is covered with strong linen drawn tight, stitched and secured, at every part of it, so as to make it fit smooth; and over this is placed a covering of oiled silk or varnished linen, making it air tight and water-proof.

In the body of the Aerostat, there are three windows, one in each side and one in the breast, in front. These are 6 inches square each, and the two at the sides are so constructed as to admit of being raised or lowered, like those of a stage coach.

And in the left side of the body there is a door, 2½ feet in height and 18 inches wide, which is opened and closed similar to those of a common pleasure carriage and fastens with a spring inside of the body. So much for the body alone, now as to the wings.

These are 12 feet long each, and are made principally of whalebone; the arm pieces of which are worked out square; the first 1½, the second 1, and the third ¾ of an inch. Their joints are similar to those in the wings of the bird, except the first at the shoulders; these, instead of being sockets, as in the bird, are like the others, plain hinges; and turn horizontally to the body. And the ends of the first arm-pieces of each wing, instead of terminating at the shoulders, project into the body 12 inches. They are therefore 5 feet long, the second 4 and the third 2 feet in length. And at those places where the first arm-pieces rest upon the sides of the body, they are inserted in square metalic boxes of sufficient size to admit their ends to pass through them; and, on each side of these boxes, there are pivots or axes upon which the wings play when in motion. These axes are ½ an inch in diameter and play in holes 1 inch long made in frames secured firmly in each side of the body.

Except one inch space at each end, the arm-pieces are all mortised entirely through their sides, ranging horizontally with the body of the Aerostat. The first and second ½ and the third ¼, of an inch wide; so as to admit the ends of their ribs to pass through them and move to the right or left, as circumstances require. And to the extreme end of the last arm-piece respectively, there is a roller or wheel attached, 3 inches in diameter, and ½ an inch thick, which turns horizontally on a pivot, in its centre. These rollers have springs attached to

them, which, when they are turned half way round, catch in notches made in their rims for that purpose. Their rims are grooved 1 inch deep half way round their posterior sides, and in this groove the last five ribs of the wings are fastened.

There are wires fastened in each arm-piece in front of the mortise immediately opposite and at the distance of 2 inches from them, the ends of which crook and enter their solid ends near the several joints of each. And the ends of the ribs, passing through the mortices, as described above, are attached to these wires by small steel hooks or rings. The ribs vary, in length, from 8 to 2 feet, tape ed down from half an inch in size at their front ends to a point at their other extremities; and so arranged as to give the exact form of the outline of the bird's wing.

The framing of the wings being thus completed, the whole is covered over with oiled silk above and below the ribs and stitched on each side of them so that they may slip backward and forward, as circumstances require, in spreading and closing the wings.

We now come to consider the RUDDER of the AEROSTAT—which is constructed in the following manner:—

A piece of strong yet light wood 14 inches long, 6 inches wide and 1 inch thick, trimmed down to the form of a common wooden shovel, is inserted into the hoop behind, so far as to conceal it all except about 2 inches of its broad end. In this situation it is suspended in the centre of the hoop on two metalic pins or axes which play in holes made in each side of it, for that purpose. The outer end of this piece of wood (which I shall hereafter call the lever of the rudder) is rounded into a half circle, and grooved out to the depth of an inch and a half; and, to a large wire, passing round within this groove, and near its bottom or termination and fastened securely to the sides of the lever, the ends of the ribs are attached. Of th[illegible] six in all, four feet long made of whalebone, and the two largest are placed on the outsides, right and left; and, like those of the wings, they taper gradually from the ends fastened to the lever, where they are ½ inch thick, to a point at their extremities. The frame being thus completed is covered above and below with oiled silk and stitched so as to confine each rib to its proper place.

The inner end of the lever is confined between two curled spiral springs, made of steel, one of which is attached to the bottom frame piece of the body, and fastened to the under side of it, and the other is attached to the top frame-piece, (answering to the spine,) and fastened to the upper side of it—immediately opposite to each other. These springs support the lever and, consequently, the rudder also, in a horizontal position to the body of the Aerostat.

The neck is made of curled wire attached to and commencing with the size of the hoop, in front, and thence tapering gradually up to the head; which is made of tin, in the exact form of the bird's. It is two feet long and is covered with oiled silk so arranged as to admit of being elevated and lowered by a cord attached to it, for that purpose.

The legs are made of curled wire also,.in the form of inverted cones. They are 3 feet long and will admit of being contracted or pressed down; one half of their length. And there are two springs in each, made of elastic wood, placed perpendicular within the spaces formed by their curles, and opposite to each other longitudinally to the body of the Aerostat.—These springs are 18 inches long, their upper ends are secured to the under part of the body, and they cross each other and are pinned together at their centres, or, half way between their ends. And there is a notch on the outside of each near their lower ends, which is so arranged as to admit the curles of the springs which form the legs to slide over them as they are pressed down by the weight in the body of the Aerostat, until they reach the feet; when they spring OUTWARD and catch upon the sides of the legs and prevent a re-action of their springs, when the weight is removed from the body. They are muffled with oiled silk, so arranged as to admit of a forward and backward movement, given them by cords managed by the Conductor, when about to alight and after starting, as circumstances require.

The feet are made of corkwood strengthened with wires, and so constructed as to expand and contract by the backward and forward movement given to the legs by the Conductor. And with these conclude the description of the internal form and construction of the body and extremities of the Aerostat. Next as to the internal arrangements and ma-

chinery. And first: the body is lined with silk,of such color as the fancy may suggest. And in that position or place where the feet of the conductor rest, there is a flooring made of strong oil cloth and corkwood.

And, on a line with the side windows, in the centre of the body, a seat is erected on which the Conductor of the Aerostat sits when it is IN TRANSITU. This seat is constructed of cork wood supported by wires, and 15 inches high. It rests upon a pivot at its centre underneath, and admits of forward, backward and lateral deviations from its perpendicular position, so as to enable the Conductor to maintain his equilibrium. The top part of it is sive-work made of wire or rush splits, with large meshes; and upon this is placed and secured an india rubber cushion, inflated with air.

Eighteen inches, in front of the Conductor's seat, two uprights are placed on each side, and eighteen inches apart, and in a line with each other, longitudinally to the body of the Aerostat. These are 3 feet long, 3 inches wide and 1 inch thick; and they stand 2 inches apart, with their edges ranging towards the head and rudder of the Aerostat. They are connected at their upper and lower ends to cross pieces of the same size, which are securely fastened, at their centres, to the principle frame pieces of the body, above and below; and the lower sill or under piece of their framing, extends entirely across the body. They are all made of corkwood, strengthened with large wires run through them lengthwise, and, if necessary to give them still greater strength, they are braced with tin.

Twelve inches below the top ends of these uprights, in the centre of their flat sides, a hole is made through the two on each side parallel with each other and, which, after being lined with steel, are half an inch in diameter each, and 15 inches below these there are two others made through the same pieces, on each side, and in the same position towards each other lined like the first two and of the same dimensions.

In the upper or first mentioned of these holes, work the axes of two wheels whose radii are 12 inches—the whole playing between the uprights, on each side. And, in the lower holes work the axes of two small wheels whose radii are 3 inches. The large wheels are made of corkwood strength-

ened with large wires run through them in various directions and, also, bound around their rims; after which they are boxed with tin. Their axis are made of steel ½ inch in diameter. The small wheels are made of strong materials—either wood or metal, as the one or the other may be found most suitable, in combining strength or power with lightness. Their axes are also made of solid steel ½ an inch in diameter. They are worked with bands, if found to be suitable, otherwise they will have cogs in them.

To the INNER ends of the axes of the large wheels, metalic cranks are attached 15 inches long; the handles of which are within the reach of the Conductor—when seated in the position above described. And. to the OUTER ends of the axes of the small wheels, metalic cranks are likewise attached, the circles described by which are 12 inches in diameter. And, to these last mentioned cranks, the lower ends of two metalic rods (one on each side) 12 inches long are connected; the upper ends of which are fastened to two slides that work in frames (somewhat like those to which the saw is fastened. in saw-mills;) fixed on the outsides of the uprights, between which the wheels play, 20 inches above the cranks of the small wheels.

The frame pieces of these slides are made of steel 1-2 an inch wide and ¼ of an inch thick; and, when put together, form frames three inches wide and nine inches long. And, to their top pieces the ends of the first arm-pieces of the wings are attached; which, as before described, project inward 12 inches beyond the sides of the body of the Aerostat.

In addition to the above, there is another important mechanical contrivance which greatly aids the conductor, in elevating the Aerostat. This consists of two springs made either of strong elastic wood or steel, secured to the ridge piece. inside of the body; the elastic ends of which project outward perpendicular to and are connected with the inner ends of the arms, by a short rod, immediately above them. These springs are equal in power to one half of the strength of a man; and I call them REGULATORS, because they give uniformity to the motion of the wings, whilst they aid the Conductor, in making the downward stroke. Thus: as the wings are raised the inner ends of their arms descend and, the springs being attached to them, are drawn down and prevent them from

flying up too quick, which they would otherwise do. And, as the wings are drawn down, which requires the greatest power, they aid the Conductor, by their elastic upward force, in drawing up their ends, inside of the body.

There are two cords belonging to each wing, one of which is used in spreading and the other in folding them. The two first pass out from the inside of the body along between the covering of the wings, in front of the arms, throughout their whole length, and are fastened to the last ribs at their extremities. They are confined to the arms by small steel rings or staples, at proper distances from each other and work upon small wooden rollers, at the shoulders. By drawing these cords the wings are spread, and they serve also to hold them in that position, while the Aerostat is IN TRANSITU.

The second couple issuing likewise at the shoulders, pass along between the covering of the wings, immediately behind the arms, and working around the rims of the rollers, at their ends, are attached to the front ends of the springs above described, and also to the last ribs of the wings. They are arranged similar to the first; and when it is desirable to close the wings, the front cords are loosened and these latter are drawn until the springs, at the extremities of the arms, are forced back out of the notches on the rims of the rollers; then the ribs fastened to the rollers are closed; next the last arm piece is drawn up and, lastly, the two remaining arm pieces, in regular succession. The wings are thus brought up to the sides of the body, and rest upon ornamented hooks placed there for that purpose.

The rudder has six cords: four of which are used in spreading and closing it. These latter are all attached to the outside ribs 12 inches from the outer end of the lever. The two first are brought forward and fastened to hooks in the framing of the machinery, on the right and left, within the reach of the Conductor. The other two pass across from the sides of the rudder to which they are respectively attached—the one above and the other below the ribs, and between these and their covering,—to the opposite sides; where they move on small rollers, fastened to the outside ribs, thence they are bro't forward and fastened to the framing of the machinery, similar to the first. The remaining two are fastened to the outside

ribs also, half way between the end of the lever and the outer end of the rudder. They cross each other immediately under it, and thence passing over small rollers near the lever, on each side, are brought forward around two other rollers, which are attached to the framing of the machinery, and fastened to the feet of the Conductor.

The lever has two cords. The first is fastened to the upper side of its inner end, and passing up through the curl of the spring on that side, and over a roller at the junction of this spring with the body of the Aerostat, thence forward to the framing of the machiney, where it is fastened, in a tightened state, to a pin which is made to slide up and down in a groove made in the edge of the upright, on the right side of the Conductor. The second is fastened to the under side of the lever, opposite to the first, and passing down through its spring, on that side, and over a similar roller to the first, at its junction with the body underneath, thence forward to a pin fastened to the upright, on the left side of the Conductor; where it plays in a groove similar to and is moved in like manner with the first.

To complete the apparatus of the Aerostat, it is furnished with a small compass, a thermometer, a barometer and a telescope; and, when travelling at night, it is lighted by a lamp.

All things being thus ready, the Conductor raises the wing on that side in which the door is placed, and opening it enters the Aerostat; and, being seated he first spreads the wings and secures their cords to hooks fixed on the ends of their inner projecting arms. He next spreads the rudder, by drawing the two cords fastened to its centre ribs, and secures their ends around the hooks above described. And then seizing the handles of the cranks attached to the axes of the large wheels, he exerts all his power upon the machinery; and, at the same time, draws the cord attached to the pin on his left side, by pressing it down with his left foot. This moves the inner end of the lever DOWNWARD and, consequently, gives the rudder an UPWARD motion or direction; and, the wind pressing against it as the Aerostat passes along forces it down and, at the same time, an UPWARD DIRECTION is given to the head, in which position it is held whilst a sufficient elevation is being attained.

Each revolution of the cranks of the large wheels produces four strokes with the wings, the points of which describe sections of a circle twelve feet in length. This motion of the wings raises the Aerostat gradually at an angle of about five degrees, during the space of 15 minutes; in which time it has traversed a distance of six or seven miles. It is now at a point sufficiently elevated above obstacles connected with the earth, and the Conductor regulates the application of the power so as to maintain his altitude; and THE MOTION OF THE WINGS and the INFLUENCE OF GRAVITATION, move the Aerostat through the atmosphere at the rate of "100 MILES AN HOUR."

The descent may be effected by merely ceasing to give motion to the wings, at the proper distance from the place of destination. But a rapid descent may also be made, at any time, by pressing down the pin with the foot, on the right side, which draws up the inner end of the lever and, consequently, turns the rudder DOWNWARD; and the wind passing rapidly underneath the Aerostat, strikes against and forces it UPWARD, whilst the head is turned DOWNWARD—and it thus descends with great rapidity. And, when within a short distance of the place of alighting, this cord is slackened and the other rapidly drawn, which turns the head up again; bringing the wings and rudder against the atmosphere, at an angle of about 45 degrees, and thus arrest its progress,—when the feet are thrown forward and the body descends gently upon them.

The Aerostat is turned to the right and left, when IN TRANSITU, by those cords attached to the outside ribs of the rudder equidistant from its ends. Thus: when it is desirable to turn to the RIGHT, the cord attached to the LEFT SIDE of the rudder and fastened to the RIGHT FOOT of the Conductor, is drawn until it (the rudder) is warped into a form and position somewhat like that of the helm of a ship or steam-boat, and the wind passing on the right side, strikes against it and turns the head to the right. And when it is necessary to turn to the LEFT, the cord attached the RIGHT side of the rudder, is drawn by the LEFT FOOT of the Conducuor, as in the other case, and the wind strikes against it from the left side of the Aerostat, and turns its head to the left.

It should be borne in mind that, in regard to the control exercised over the Aerostat, by the means and in the mode

here described, it is considered as moving forward with greater or less velocity. And, in an exact ratio to its speed, will the surface presented by the rudder have to be greater or less to accomplish any of the movements above described.— In other words, the speed of the Aerostat, is as important to its guidance as the density of the water is, to the steering of a ship by the ruddder or helm. The principle in fact is the same in each case.

The only extraneous obstacle to be encountered in my plan, is the blowing of the winds. If, however, the speed of the Aerostat should be as great as I have stated, it will be perceived that the force of ordinary winds as well the uniform as the counter currents, will have but little effect in opposing its progress or in turning it out of its course. Because, it is obvious that, a body or machine constructed as mine is, passing through the air at the rate of 100 or even 50 miles an hour, must be met by a counter power or opposing force, in the nature of the wind, equal to its velocity, in order to arrest its progress. Now the ordinary winds move at the rate only of from 5 to 10 miles an hour, and their greatest velocity, as in the cases of hurricanes, tornadoes and tempests range from 60 to 100 miles an hour. These latter, however, may generally be avoided, either by turning to the right or left of them, when discovered ahead by the Conductor, with the aid of the telescope, or, by rising above them. But their recurrence is so seldom in this country as to render them, in the shape of an objection or difficulty in my mode of Aerostation, unworthy of serious consideration. And, in regard to the mere ordinary high winds, it will be observed that, in case of their blowing from any particular quarter for a considerable length of time, they will retard the progress only (and delays must occur in this, as well as all other modes of travel) of those who are going directly to that point, whilst they will be of great advantage to all others who may be going in the opposite direction.

CONCLUSION.

Among those gentlemen to whom I have heretofore confidentially disclosed my plan, some of them are of opinion that my machinery is too COMPLICATED; and, they say, that this is the only difficulty which presents itself to their minds.

Others see no COMPLICATION in it whatever, but think my POWER is not sufficient.

A third class contend that it will be impossible for me to impart to the wings of the Aerostat, a peculiar motion in imitation of the muscular motion of the wings of birds, and which they think, is indispensable to the success of my project.—Whilst they have no doubt about the sufficiency of the POWER, and see no COMPLICATION in the mechanism.

And there is yet a fourth class who may be styled (and I do it with the most cordial good feeling towards them) doubting Thomas'—touching the practicability of my plan, both as to the construction of the machinery and the application and effect of the power, and, as a whole, with regard to the result. They must have ocular demonstration before you can persuade them to believe.

As to the COMPLICATION of the Aerostat, I grant, that, take it all together, it will be a little difficult to construct at first.—In the formation of the wings especially, there will have to be the greatest accuracy and precision in giving to them that necessary and peculiar curve underneath and oval forms above, which we see exhibited in those of birds. But still, may not this be done, even with the utmost precision, having the model continually before our eyes? No one, it seems to me, can doubt this for a moment. Compared with many other things, the watch—timepiece—for instance, or a steam engine, the machinery of a cloth or spinning factory—and the complication of the Aerostat, disappears at once.

And, as to the machinery inside of the body, I would ask, in all seriousness and candor, whether there is really any complication in it at all? There are two wheels on each side or, to each wing, which work upon each other, with a crank to each.

The power is applied to one of these cranks and the wings are put in motion by a rod connecting them with the other. Was there ever any thing, except a wheelbarrow, in the nature of machinery, more simple and plain! If there is complication in a wheelbarrow, then, the machinery of the Aerostat is also complicated.

In regard to the POWER, I think that there can be as little doubt about its sufficiency, as there is in regard to the simplicity of the machinery. But as this is an objection of a more grave character, it becomes necessary to pay more particular attention to it.

The machinery of the Aerostat is, in nature, a compound lever; and without entering into a mathematical calculation or demonstration of its power, it is sufficient for my present purpose to state, that, nothing or but very little is lost, of the power applied at the cranks, in its passage to the wings.—And, it will be recollected, the wings move four times as fast, or, in other words, make four strokes while the cranks perform one revolution. Then, I am safe in saying, that, in this case, there is a facility imparted to the wings equal, in effect, to four times the power applied to the cranks. Let us illustrate this position by a single case.

Taking it for granted, for the present, that my power is sufficient to put the wings in motion, we will suppose, that, by the first stroke given them, which occupies the time of two seconds, and employs all the power of the Conductor, the Aerostat is raised twelve inches; and, in two seconds more, the time occupied in raising them again, it falls back three fourths of that distance or 9 inches. And, at that point, another stroke is made which raises it again the full twelve inches, and again it falls back the 9 inches, and so on.

Now it will be perceived, in this case, that it would take four strokes of the wings, occupying the time of sixteen seconds, to raise the Aerostat twelve inches; and, consequently, it would rise only 3 feet 8 inches in a minute, and 220 feet in an hour. But, if the machinery be so constructed as to give fourfold velocity to the wings (as is the case with the Aerostat) compared with the motion or velocity where the power is applied, we will see that, while the same time (four seconds) is occupied in performing one revolution of the

cranks, a vast difference results from the same amount of power. Thus: taking the above supposed data of twelve inches elevation for each stroke of the wings, produced by one revolution of the cranks, and we have, as the results, 3 feet 3 inches elevation in four seconds; 47 feet 3 inches, in sixty seconds or one minute; and 2835 feet in sixty minutes or one hour. It is clear, therefore, that VELOCITY, in this case, is POWER; however it may be in others.

Then, there are two wings, each twelve feet long and varying in width from four feet at the body to a point at their outer ends, weighing 3 to 5 pounds, (they will not exceed 5 pounds each) the heaviest parts of which are near the place where the power is applied—to be put in motion, in the atmosphere by the strength or power of a man. And, the question arises, can he do it by the means and in the mode adopted in the Aerostat?

The reader will perceive at once, that, to discuss this question properly and demonstrate the quantum of power required, we would have to enter into a new field of philosophical enquiry. The density or resistance of the atmosphere to a certain superfice, in the shape of wings, made air-tight and brought into contact with it with an ascertained velocity; the nature of the machinery employed; the length of the stroke or distance of the points from each other between which the ends of the wings play, and the weight to be elevated, are all concerned in the settlement of this question. And besides, the only mode of ascertaining facts in regard to this matter, is by experiment. Ornithology furnishes us with no data in this case farther than may be gathered by common observation. Ornithologists have gone and relied too upon anatomical invettigations, in forming their opinions upon the relative or comparative strength of birds with men. And I have great doubt, after much reflection on the subject, as to the correctness of what is certainly nothing more than inductive philosophy, in regard to this matter.

I will not therefore enter into a philosophical discussion of these matters at this time, but will endeavor to throw as much light upon the subject before us as may be elicited by reasoning from analogy. Aye, analogy drawn from nature and not, therefore, obnoxious to the charge "*deceptive*" which has been

very injudiciously applied to all analogical reasoning. There is, by the way, a species of this kind of reasoning which, I grant, is deceptive and dangerous; but analogy drawn from nature, in all cases, furnishes the foundation, in my opinion, of the only true philosophical reasoning, when experiment cannot be resorted to. And it were well if it was more frequently employed and relied on, in the investigation of obstruse questions. But to the point before us.

The wisdom of God is most beautifully displayed in all created things. Man is so organized in his physical structure as naturally to stand erect and walk abroad upon the earth; and, upon this grand substruction, he plants his feet and wields his physical power. So, also, of all other animals which belong strictly to this first great element of the world. To the next most dense and important and palpable element, the organization and nature of the fish creation are wisely adapted. The great Leviathan, the Whale and the Shark are powerful only when in the "*mighty deep*." And, in the third and last naturally prominent element, we find an equally grand display of natural congruity with and wise adaptation in the organization of, the "fowls of the air," to it. The condor, the cormorant, and the eagle display their greatest powers in soaring aloft with their prey and, in traversing vast tracts of country, with the swiftness of the winds.

Man, standing erect upon the earth and employing his muscular power, exerts his strength in walking, running and moving heavy bodies from one place to another. The fish is buoyed up in an ambient fluid of sufficient density to resist the pressure of his fins, when, by his muscular power, they are brought in contact with it; and he is enabled thus to force his way through it, with great rapidity. And now see the beauty and philosophy of the mode by which the bird exerts his strength and moves upon an element which is just as suitable and as firm a foundation, so to speak, in his case, as the water and earth are, in the cases of the fish and man. He stands not erect, like man, nor is he buoyed up, like the fish; but he spreads his broad wings which are exactly adapted to the element in which they play. These are his feet, compared with man, and the density of the water and the fin compared with the fish, in regard to speed. It is, therefore, just as easy for

the bird to accomplish locomotion in his mode as it is for man to run upon the earth and the fish to swim in the water. Not that the bird is stronger in proportion to his size and weight, as is generally supposed, than any other animal and, especially man; but because his means, like the others, are suitably adapted to the element in which he lives, without regard to strength.

Man carries himself along by alternate strides with his feet, being erect in his position; the fish moves himself along, on the same principle, in an element which admits of his passing through it, in a horizontal position, by the strides, if you please, of his fins; and the bird, on the same principle also, walks abroad upon the elastic atmosphere. Like a man, to use a figure, walking upon elastic ice, when every step he takes slips him forward with great velocity.

Then we need not go in search of greater muscular power, in order to understand and explain how it is that the bird is enabled to rise upon the atmosphere. The size and form of the wings and the velocity with which they are exerted, philosophically considered, explains the whole matter; and, at once, sets aside the vague conjectures about inflating his body and even the bones of his extremities with air, which, it is said, is often done. In matters of this sort, every thing must be considered in the concrete—nothing in the abstract.—Viewed in this latter mode, difficulties present themselves on every hand; hence philosophers have been driven to the imagination, in order to explain what they did not reason on and, consequently, could not understand; and from its fruitful fields have amply stored a large portion of the garner of ornithology.

May we not infer then, that man is as strong in proportion to his size and weight as birds are? I think we may. And, if so, it follows as a matter of course, that he has power enough, when exerted on the same kind of means which the bird uses, to elevate himself upon the atmosphere. But, as already shown, in reference to the nature of the machinery and application of the power used in raising the Aerostat, the Conductor has the advantage of a lever, so arranged as to enable him to exert his strength on it in that way in which he is most powerful, and, at the same time, give a velocity to the wings equal, in effect, to four times his own strength.

But, after all, if these fail or are found to be insufficient to raise the Aerostat, I shall not be left without resources by which my object may be accomplished. Superadded to these I can employ *hydrogen gas*. And to do this the size of the body above described is enlarged six inches geometrically; so as to make 9 feet long, 4½ deep and 4½ wide; leaving a space betwixt the framing of the body and the lining inside of about 35 cubic feet, to be filled with this gas.

Before starting, the body of the Aerostat is inflated with gas in a few minutes,from a reservoir where it is kept for that purpose (for it may be generated and kept like any strong liquors) and confined within it, by an air tight screw, till the rout is performed. But this gas must not be used to such an extent as to be sufficient, of itself, to raise the Aerostat, it must be employed as an auxiliary only to aid the Conductor in elevating it. For I have not the least doubt but that the influence of gravitation is indispensable to Aerostation; and that without it the birds could not control their bodies in the atmosphere. A matter which, it seems, the philosophical world have entirely overlooked; or else, ballooning would long since have ceased.

And, as to the motion of the wings, any one may satisfy himself, by a little observation, that there is no other than a *perpendicular stroke* given to their wings by birds when flying. The wings of the Aerostat move in the same way.—That the whole physical organization of the body is remotely concerned in this motion, I have no doubt; just as the whole body or muscles of man are concerned in his walking. But it is the immediate operation of the wings of birds as it is the strides of man, which elevates the one and carries along the other.

In the event of an entire failure in the machinery and power employed to give motion to the wings of the Aerostat, as described in the foregoing plan, I have contemplated two other modes or the employment of two other powers, and machinery differing from the first, either of which, I am persuaded, will be found practicable.

The first of these plans is worked by ATMOSPHERIC PRESSURE and CARBONIC ACID GAS; and the machinery consists, in brief, of a *glass cylinder* 15 inches long and 9 inches in diameter,

placed perpendicular in the centre of the body, 15 inches in front of the Conductor's seat. On each si le of this cylinder there are uprights secured to the bottom of the body, the top ends of which are 6 inches above the arm pieces inside of the Aerostat. On the tops of these uprights there are levers, the long ends of which are attached to the *piston rod* of the Cylinder; and to their short ends the inner ends of the arms are attached, by metalic rods. The cylinder has two valves near the bottom, one in the side next to the Conductor and one in the opposite side, which are worked by the levers somewhat like those of a steam engine.

In order to work this machine, it will be necessary to produce a *vacuum* under the head of the *piston*, within the cylinder. It is believed that this can be done by *carbonic acid gas;* which is known to have an expansive power equal, if not greater, than that of steam. Or, if it cannot be used in its *expansive*, perhaps it may answer the purpose, when combined with other substances, in its *explosive form.* Such, for instance, as gun-powder—the constituent property and elementary power of which is *carbonic* and *acid gas.* The utmost care, of course, must be exercised in employing this subtle and deadly agent; but not greater, I opine, than is necessary in the use of steam power. For, when this, by explosion or any other means, escapes from the boilers, it is equally destructive of life and property, as that of *carbonic acid gas.*

But, I deem it unnecessary to explain farther or discuss the merits of this plan, at this time, as its practicability can be tested only by experiment.

The second plan seeks to obtain a power in the element on which the Aerostat moves—in the nature of the force exerted in the blowing of the wind,—and the machinery consists of a *power wheel* with wings or paddles, somewhat like those of a steam boat, the shaft of which is 24 inches long, and it is placed in a lateral and horizontal position to and 24 inches in front of the axis of the large wheels, before described in the plan first above mentioned. On each end of this shaft there are wheels the radii of which are 12 inches. These have cogs in them and work on the cogs of those put in motion by the Conductor, which latter, under this arrangement, stand

24 instead of 18 inches apart. The arms and paddles project out above the back of the Aerostat, and are covered above with a protuberance of light materials which is open in front, the exact size of the paddles, and a little displayed behind. The paddles are two feet square; and so constructed as to avoid the reflective force of the wind against one of them whilst it is playing directly against another. There is a frame made of oiled silk 2 feet wide and 4 feet long, in the form of a half circle, and placed below the shaft of the power wheel, and attached to the framing, at the top of the body, inside. In this silken frame or box the paddles of the power wheel play, when in motion; and it is also intended to prevent exposure to the wind from the paddles and the weather from without, coming through the opening mode for the operation of the paddles, above the back of the Aerostat.

In order to work this machine an elevation of some 300 feet is first obtained by means of a bag or BALLOON made entirely of silk, which is attached to the back of the Aerostat, and inflated with *hydrogen gas*. This being accomplished, the wings are spread and the gas is suffered to escape out of the bag; after which it is taken into the body, and the whole weight is suspended on the wings,—and it descends with great velocity, at an angle of 10 to 15 degrees. In an exact ratio with its downward tendency the wind is exerted against the paddles of the power wheel; and, in an equal ratio with its force, the wings are exerted, on the atmosphere—tending, in the nature of the case, both to maintain the altitude and accelerate the speed of the Aerostat.

I feel great confidence in the practicability of this mode of obtaining a power, which in the event of a failure in the others above described, will be all sufficient for the purpose of Aerostation. This belief rests on the fact, that, a force equal to FIFTY POUNDS is exerted by the wind, upon every SQUARE FOOT, at a speed of 100 miles an hour, In the above case the paddles are TWO FEET SQUARE, and consequently, present, in each, a superfice of FOUR feet; therefore, the force exerted upon the *power wheel* will be equal to 200 pounds. Add to this the strength of the Conductor, and we have a power equal to 350 pounds: which is full sufficient for the transportation of *two persons* of ordinary weight, and 50 pounds of baggage

or mail. Allowing that nothing is gained by the velocity imparted to the wings.

It will be perceived that, under this arrangement, the blowing of the wind, instead of being a disadvantage, will aid the Conductor, in going directly against it. The stronger it blows the faster will be the speed of the Aerostat. It acts upon the paddles of the power wheel, on the same principle, in this case, that the water does, when let loose upon the wheel of a mill; and, like the water, having spent its force against them, escapes over the back behind. It is regulated, therefore, in the same way—by a gate which is protruded out above, a little in front of the paddles, and which is raised and lowered by the Conductor, according to circumstances.

Thus I have given a brief outline of the several plans of construction, the modes of operation, and the powers which may be adopted and employed in constructing the machinery of and propelling the Aerostat. These are submitted to the public more in the nature of suggestions than any thing else. The *principle*, however, on which it is founded and the form adopted are indubitably correct. They must not be departed from, if we would ever succeed in grappling with and overcoming the elasticity of the air,—in transporting ourselves through it, from one place to another.

And I here repeat my former offer, with the view to obtain sufficient means for experimenting on my plan, viz: I will obligate myself to pay the sum of *fifty thousand dollars* for and in consideration of the loan of *five thousand dollars*—predicated on the practicability of the invention. Or, if this should be considered too small a premium, I will enter into still more favorable terms with any w o may be disposed to aid the project by testing its practicability—provided the means should be provided at once and the work of experimenting, commenced without delay.

Americans! Will you suffer this invention—aye, this *new invention*—for it has never yet been tried in any age or country, nor by any person living or dead—to remain untried merely because you may not be *fully satisfied* that it *will succeed?*—till this disclosure of it shall have crossed the wide waters, and the plan which it suggests is experimented on and carried into practical operation, in another country? Re

member what we were told but a few years ago by the immortal Fulton, in regard to a thing which was then looked upon as equally remarkable and impracticable as my project now is, when nobody believed him until he astounded the world by ocular demonstration of its practicability.

If it must be so I shall most assuredly labor and toil, as Fulton and others have done, until I accomplish it by my own resources. For it WILL—it MUST—it SHALL succeed!